



Prepared for:

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Report of Prof. David F. Babbel
in
Washington State
Tobacco Settlement Authority
against
Lehman Brothers Holdings Inc.

U.S. Bankruptcy Court, Southern District of New York
Case No. 08-13555 (SCC)

Prepared by:

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Date: February 24, 2014

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1. Introduction and Qualifications

1.1. Qualifications

My name is David F. Babbel. I am Emeritus Professor at The Wharton School, the University of Pennsylvania, where I have been teaching and conducting financial research since 1985. I am also a Senior Advisor in the Finance Practice at Charles River Associates. I received a Ph.D. in Financial Economics from the University of Florida Graduate School of Business Administration in 1978. I also completed post-doctoral study programs at the University of California at Berkeley in financial theory and option pricing, and was a post-doctoral fellow in risk and insurance at The Wharton School of the University of Pennsylvania. Prior to my appointment to the Wharton faculty, I was a finance, and international finance professor at the University of California, Berkeley from 1978 through 1985.

Among the finance classes I have taught are: Investments and Securities Markets (executive, graduate and undergraduate levels), Financial Markets (graduate and undergraduate), International Financial Management (executive and graduate), Advanced Corporate Finance (executive, graduate and undergraduate), and Structured Notes and Asset-Backed Securities (graduate).

I have had a non-academic executive appointment at Goldman Sachs & Company as a financial strategist and Vice President. The appointment at Goldman Sachs & Company began in 1986 where I served as a special consultant in the Financial Strategies Group of the Fixed Income Division. I then took a one-year leave of absence from Wharton in 1987 and was assigned to the newly created Pension and Insurance Group, where I directed all research. Although I returned to Wharton to resume my professorial duties in 1988, I was retained by Goldman Sachs as a Senior Advisor on a part-time basis for an additional six years. In this role I directed, conducted, and published research on the financial markets and the insurance industry.

I have also had a non-academic appointment at the World Bank as a Senior Financial Economist in 1995. While serving there, I developed and priced loan guarantees on debt and I co-authored several financial studies including one on the valuation and duration of risky debt and another on insuring against default on sovereign debt instruments.

As my attached *curriculum vitae* at Exhibit 1 details, I have authored or co-authored over 100 books, monographs, and articles on finance, investments, insurance, and valuation topics. Of particular relevance for this matter are: the textbook ***Financial Markets, Instruments & Institutions*** co-authored with Professor Anthony Santomero,¹ the monograph ***Valuation of Interest-Sensitive Financial Instruments***,² "Duration and the Term Structure of Interest

¹ Anthony Santomero and David Babbel, *Financial Markets, Instruments & Institutions*, McGraw-Hill Irwin Publishers, 1st Edition 1997, 2nd Edition 2001.

² David F. Babbel and Craig B. Merrill, *Valuation of Interest-Sensitive Financial Instruments*, SOA Monograph M-FI96-1, Society of Actuaries, 1996.

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Rate Volatility,”³ and “Interest-Rate Option Pricing Revisited.”⁴ Additional articles that have a bearing on the valuation approach include “Quantity-Adjusting Options and Forward Contracts” and “Generalized Put-Call Parity.”⁵ I have extensive experience consulting with major companies in finance and insurance. I have been engaged in financial consulting assignments with major clients involving investment valuation, asset allocation, risk management, strategy, and asset/liability management. I have assisted leading firms in the development of software for the valuation of assets and liabilities. During my career, I have served as an expert witness or consultant for the U.S. Department of Justice, the Federal Trade Commission, the Commodities Futures Trading Commission, the Federal Bureau of Investigation, the Resolution Trust Corporation, the U.S. Department of Labor, the Pension Benefit Guaranty Corporation, and the U.S. Treasury, as well as for a number of private clients. A list of expert testimony I have given since 2009 is attached to expert disclosure materials submitted by Jones Day.

1.2. Assignment

I have been asked by Jones Day, Counsel for Lehman Brothers Holdings, Inc., to review and comment on certain aspects of the “Expert Witness Valuation Report” submitted by Daniel Curry and Jeffrey Hasterok (the “Curry and Hasterok Valuation Report” or the “Report”).⁶ Messrs. Curry and Hasterok submitted this Report on behalf of the Washington State Tobacco Settlement Authority (“TSA”) in support of its claim against Lehman Brothers Holdings Inc. (“LBHI”) and Lehman Brothers Special Financing Inc. (“LBSF”) in U.S. bankruptcy court (the “Lehman bankruptcy proceeding”). TSA’s claim arises from the rejection of the Reserve Fund Agreement (the “RFA”) between TSA and LBSF, dated November 5, 2002.⁷ The Curry and Hasterok Valuation Report purports to calculate the “Termination Amount” of the RFA, which forms the basis of TSA’s bankruptcy claim. Messrs. Curry and Hasterok contend that LBSF and LBHI owe TSA \$37.5 million in order to put TSA back in the same position it would have enjoyed had the RFA not been terminated. This \$37.5 million, according to Messrs. Curry and Hasterok, constitutes the difference in the interest that would have been earned by TSA under the RFA if it had not been terminated and the amount that TSA will earn on the Reserve Fund of approximately \$45.5 million through

³ David F. Babbel, “Duration and the Term Structure of Interest Rate Volatility,” in G. Bierwag, G. Kaufman, and A. Toevs, Editors, *Innovations in Bond Portfolio Management: Duration Analysis and Immunization*, (New York: JAI Press, 1983) 239-265.

⁴ Craig Merrill and David Babbel, “Interest-Rate Option Pricing Revisited,” *Journal of Futures Markets*, Vol. 16, No. 8, (December 1996) 859-863.

⁵ David F. Babbel and Laurence Eisenberg, “Quantity-Adjusting Options and Forward Contracts,” *Journal of Financial Engineering*, Vol. 2, No. 2 (June 1993) 89-126 and “Generalized Put-Call Parity,” *Journal of Financial Engineering*, Vol. 1, No. 3 (December 1992) 243-263.

⁶ Daniel Curry and Jeffrey Hasterok, “Expert Witness Valuation Report: Washington State Tobacco Settlement Authority 2002 Reserve Fund Agreement,” December 16, 2013.

⁷ The RFA was between TSA, LBSF and U.S. Bank, N.A., as trustee. LBHI guaranteed LBSF’s performance under the RFA.

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May 2032 under the assumptions adopted by Messrs. Curry and Hasterok.

Charles River Associates ("CRA") is being compensated \$745 per hour for my time plus its standard professional billing rates for other personnel assisting me. CRA's total billings are subject to a cap and conditions as specified in the retention letter with Jones Day, which is attached as Exhibit 2 to this report.

1.3. Materials Considered and Research Conducted for This Matter

The research I have conducted in this matter has been informed by my education, knowledge, and experience in finance and investments. I have reviewed and compiled materials as cited in this report with the assistance of Charles River Associates personnel working under my direction. Materials I have reviewed arising specifically from this matter include:

- Reserve Fund Agreement by and among the Tobacco Settlement Authority, U.S. Bank, N.A., and Lehman Brothers Special Financing, Inc. dated November 5, 2002;
- Amendment Agreement by and among the Tobacco Settlement Authority, U.S. Bank, N.A., and Lehman Brothers Special Financing, Inc. dated March 26, 2003;
- Expert Witness Valuation Report submitted by Daniel Curry and Jeffrey Hasterok on December 16, 2013;
- Deposition of Daniel Curry, January 17, 2014; and
- Deposition of Jeffrey Hasterok, January 16, 2014.

Information from sources in the public domain are also used and cited specifically in this report.

The citations in the footnotes of this report list the materials I have considered in the formation of my opinions. I reserve the right to modify or expand upon my opinion should additional relevant information become available or brought to my attention after the date of this report.

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2. Summary of Opinions

Based on the materials I have reviewed and analyses conducted to date, I have arrived at five opinions pertaining to this matter, which I summarize below.

1. Messrs. Curry and Hasterok's use of historically low short-term interest rates to compute the flow of cash shortfalls that TSA would experience as a consequence of the termination of the RFA, as well as using those same low short-term interest rates for discounting that flow of cash shortfalls, yields a Termination Amount that overcompensates TSA for the loss of the economic terms of the RFA.
2. The forward rates in the term structure of interest rates as of March 25, 2009 require the use of a rate substantially higher than the 0.65% assumed by Messrs. Curry and Hasterok to discount the replacement cash flows. To do otherwise would imply values that have nothing to do with the values seen in the marketplace.
3. Messrs. Curry and Hasterok's assumption that a 0.65% interest rate will prevail in all six-month periods from March 2009 through May 2032 is speculative, unsupported by any financial theory or industry practice, ignores the historical record, and is inconsistent with reasonable financial market expectations.
4. The upward sloping of the term structure of interest rates reflects the financial markets' expectations that interest rates will revert to more historically prevalent and higher levels.
5. Messrs. Curry and Hasterok's opinion that TSA should not use the forward curve to determine the Termination Amount because it is unable to transact at or lock-in those rates reflects a lack of understanding of the fundamental economics of the circumstances. The economic value lost to TSA can be calculated in present value terms without any need to establish that TSA will be able to transact at or lock-in those interest rates in the future. A forward delivery contract like the RFA must be valued using forward rates. That is the market and industry standard, and supported by basic financial theory.

The remainder of this report presents the analyses and bases for the summary of my opinions outlined above.

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3. Observations on the Curry and Hasterok Valuation Report

The Curry and Hasterok Valuation Report purports to calculate a “Termination Amount” of the RFA by determining, in their words, a “replacement rate” for the terminated RFA and comparing that to the “Guaranteed Rate” of the RFA, from March 25, 2009 through May 2032. Messrs. Curry and Hasterok opine that from March 2009 through May 2032, TSA will be able to obtain a replacement rate reflecting only the historically low short-term interest rates existing in the aftermath of the Financial Crisis and the monetary regime of Quantitative Easing engineered by the U.S. Federal Reserve Board. Messrs. Curry and Hasterok assume a replacement rate and discount rate of 0.65% in calculating the “Termination Amount due from LBSF (and LBHI, as guarantor) to TSA. . . .”⁸

3.1. Background on Term Structure of Interest Rates

This section explains the term structure of interest rates, spot rates, and forward rates and then discusses the proper use of forward interest rates embedded in the term structure of interest rates.

Starting with some very basic observations, note that fixed income securities are available for different lengths of time: from overnight to perpetual (i.e., never maturing) and many points in between. Practically speaking, there are generally more fixed income instruments with relatively near-dated maturities than long-dated maturities.

Most often, the interest rate borne by a debt instrument depends on the length of time until it is paid off, or matures. “The **term structure of interest rates** is the name given to the pattern of interest rates available on instruments of a similar credit risk but with different terms to maturity.”⁹ A **yield curve** is a “graph showing the term structure of interest rates by plotting the yields of all bonds of the same quality with maturities ranging from the shortest to the longest available.”¹⁰ There are three main types of yield curves that are typically plotted: yield-to-maturity curves (par curves are a subset of this), spot rate curves, and forward rate curves. As will be explained later, the first of these has very limited use because the yields-to-maturity cannot be used to discount future cash flows for valuing any security unless it is an *exact* replica of the securities used to construct the yield-to-maturity curve – the coupons need to be exactly the same, the maturities identical, and the liquidity and credit risk indistinguishable. While yield curves based on par rates (and yield-to-maturity rates) are widely available, rigorous fixed income analysis generally starts with a spot rate of interest and a yield curve portraying the term structure of spot and forward rates. Accordingly, our

⁸ Curry and Hasterok *Report*, p. 20.

⁹ Santomero & Babbel, 2nd Ed., p. 78.

¹⁰ John Downes & Jordan Elliot Goodman, *Dictionary of Finance and Investment Terms*, 7th Ed., Barron's. 2006, p. 804.

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focus will be on the yield curves that are most useful – the spot rate curves and the forward rate curves derivable from the spot rates.

“A spot rate of interest is the annual rate of interest that you could earn (or would pay if you were a borrower) on an investment (or loan) made today, which would be repaid with interest on a specified date in the future.”¹¹ The spot rate of interest has only one incoming cash flow at maturity. In other words, while par (and yield-to-maturity) term structures depict yields that reflect multiple cash flows arriving at different times, the spot term structure reflects a single pure rate of interest involving a single cash outflow at one point in time and a single cash repayment at another, later point in time.

We now get to forward interest rates. Embedded in the term structure of spot rates of interest are forward interest rates, which apply from one point in time in the future to another point in time in the future. “Forward rates are those single-period implied rates of interest that would give rise to the observed spot rates of interest.”¹² The difference between spot and forward rates of interest is clarified using a time line illustration as in Figure 1.

In Figure 1 the passage of time is represented by movement from left to right on the horizontal axis. Let today (or the starting date of an analysis) equal Time 0. The S_t lines below the time line represent the t -year annualized spot rates of interest over a specified interval. Each spot rate starts today and applies (on an annualized basis) over the interval until the financial instrument matures, be it one month, two years, or thirty years. The forward rate of interest, on the other hand, is represented by the f_t . Each forward rate pertains to a specific period of time within an interval, for example, the beginning to the end of year 3. If you know the spot rates over the interval from Time 0 to any other Time, you can extract the forward rates.¹³ Similarly, if you know the forward rates for each time period, you can calculate the spot rate for any particular interval.¹⁴

To give an analogy, if you had sprinted a distance of 100 yards in 10 seconds (analogy to a spot rate of interest), and reached the 50 yard line in 5.5 seconds, you could calculate that the remaining 50 yards were covered in 4.5 seconds (analogy to a forward interest rate). To give an algebraic analogy, $5 + x = 8$. In this case, $x = 3$. To suggest that “3” is speculative, unreliable and ambiguous is similar to suggesting that forward rates are speculative, unreliable and ambiguous. On the contrary, forward rates are definitional, and very simply derived from the underlying spot rates of interest.

¹¹ Santomero & Babbel, 2nd Ed., p. 74, emphasis in original.

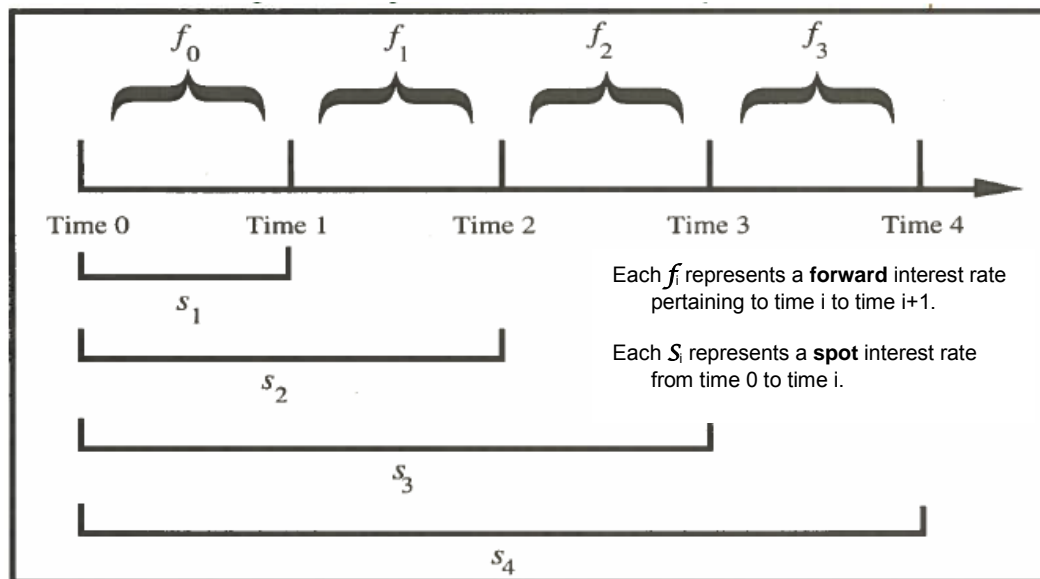
¹² Santomero & Babbel, 2nd Ed., p. 74.

¹³ The forward rate, f_{t-1} , in terms of the spot rate, S_t , is equal to: $[(1 + S_t)^t \div (1 + S_{t-1})^{t-1}] - 1$.

¹⁴ The spot rate, S_t , in terms of the forward rate, f_t , is equal to: $\sqrt[t]{(1 + f_0) \times (1 + f_1) \times \dots (1 + f_t)} - 1$.

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Figure 1: Representation of Spot vs. Forward Rates of Interest

Source: Babbel & Merrill, *Valuation of Interest-Sensitive Financial Instruments*, SOA Monograph M-FI96-1 (1996), Figure 1.2, p. 3.

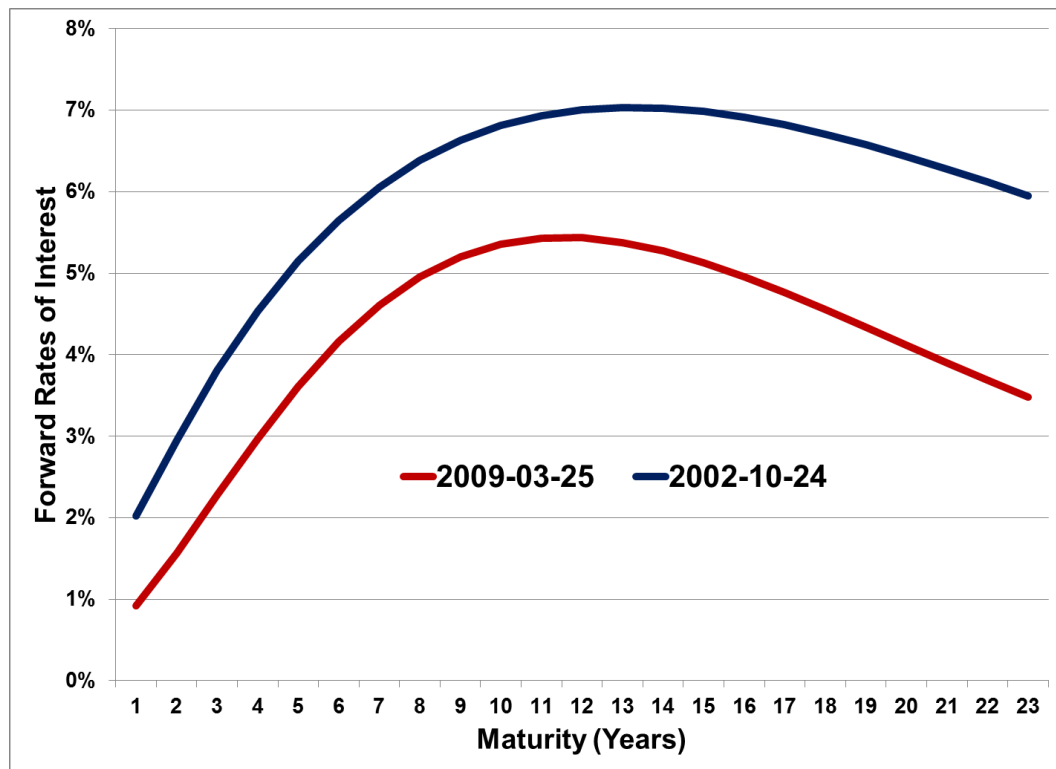
Figure 2 below presents an example of a US Treasury forward rate curve at two points in time relevant to this dispute – October 24, 2002 and March 25, 2009. The first date, October 24, 2002, is the bid date on the original RFA. The upper yield curve (in blue) depicts the term structure of US Treasury forward rates on that date. The second date, March 25, 2009, is the Valuation Date. The lower yield curve (in red) depicts the term structure of US Treasury forward interest rates on that date. Each of the forward rates depicted is applicable to a single year, maturing at the end of the year indicated. I present these yield curves in Figure 2 to depict general interest rate conditions and provide an introduction to some of the issues relevant to the dispute on the Termination Amount.

I have several initial observations about the yield curves depicted in Figure 2, and I will expand on these observations as they relate to the calculation of the Termination Amount as this report proceeds. First, note that both yield curves are generally upward sloping (from left to right, as the years to which they apply extend further into the future), but that beyond some point between ten to twelve years, begin to decline. Second, note that forward interest rates were generally higher in October 2002 than in March 2009 – from 1% to 2.5% higher depending on the applicable year. In particular, note that the near-term rates for March 2009 are very low – the first-year rate is below 1%. From that point, the interest rate rises quite steadily to the ten year point, and then declines. Observe also that the lowest forward interest rate shown on the 2002 curve was also fairly low – around 2%. The patterns I observed are easily discovered and are fundamental to a proper valuation of future cash flows. As this report proceeds, I will explain how Messrs. Curry and Hasterok largely ignore these patterns and, consequently, their calculations of the Termination Amount are unreliable.

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Figure 2: US Treasury Yield Curves on Two Relevant Dates



Source: Refet S. Gürkaynak, Brian Sack, and Jonathan H. Wright, *The U.S. Treasury Yield Curve: 1961 to the Present*. Finance and Economics Discussion Series, Divisions of Research & Statistics and Monetary Affairs, Federal Reserve Board, Washington, D.C., 2006-28 at <http://www.federalreserve.gov/pubs/feds/2006/200628/200628pap.pdf>.

Yield curves, as the graphical visualization of the term structure of interest rates, can have a number of different configurations reflecting the different interest rates at the various maturities.¹⁵ Over time, general interest rate levels have changed substantially and they have exhibited different slopes, sometimes upward, sometimes downward, sometimes bumpy or peaked, and sometimes essentially flat. The spot interest rate yield curves (shown later) have also exhibited varying degrees of curvature or bend, with generally more curvature observable in the zero to three year range of maturity than in longer maturities.¹⁶ The spot and forward interest rates exhibited across the various maturities in the yield curves reflect the demand and supply conditions for credit at those maturities as well as opportunities for arbitraging trades across the maturities.

¹⁵ I presented examples of the term structure of interest rates at widely differing points in time in both Santomero & Babbel, 2nd Ed., Exhibit 5.2 on p. 78, and Babbel & Merrill, *Valuation of Interest Sensitive Financial Instruments*, Figure 1.5 on p. 8.

¹⁶ Santomero & Babbel, 2nd Ed., p. 78.

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3.2. Commentary on Messrs. Curry and Hasterok's Use of the Term Structure of Interest in Valuing the Termination Amount

With the preceding as background, two related questions on the term structure of interest rates are relevant to the dispute at hand. First, what are the economic factors that determine the shape of the yield curve? Second, and quite closely related, does the shape and position of the yield curve offer any predictions regarding future interest rates?

In valuing their Termination Amount, Messrs. Curry and Hasterok have selected an expected maturity date of 28-May-2032 for the RFA, have assumed semiannual cash flows of a particular and constant amount going forward from March 25, 2009 until maturity 23 years later, and have discounted those assumed cash flows back to March 25, 2009 to establish what they purport to be the present value of the Termination Amount as of March 25, 2009, had the RFA not been terminated. As I reviewed their work, I conclude that Messrs. Curry and Hasterok's calculation of the Termination Amount will certainly yield TSA substantially more than TSA contracted for with LBSF in the RFA.

I note that Messrs. Curry and Hasterok have assumed cash flows accruing to TSA under a replacement yield without a basis in any finance theory or practice with which I am familiar, yet are at such a high level that they too will certainly increase the computed value of their Termination Amount.¹⁷ Finally, they have selected discount rates for the cash flows that are so low that they will certainly raise the computed value of their Termination Amount beyond any that can be justified from standard valuation principles used in finance theory and practice.¹⁸ The combination of choosing higher net cash inflows and lower discount rates will certainly increase the valuation of the fixed leg of the Termination Amount far, far above what a legitimate valuation would produce.

3.3. Forward Delivery Agreements

At the outset, I note that in 2002 "TSA engaged Public Financial Management ("PFM") to select an eligible provider for a forward delivery agreement [*emphasis added*] of Eligible Investments to invest the proceeds of the Liquidity Reserve Account, as defined by the Indenture."¹⁹ Such a forward agreement would naturally elicit forward rates as a basis for valuation of the agreement. The forward rates of interest appropriate for valuing forward commitments are readily available in numerous market sources, or can be easily computed from basic fixed income securities pricing data. These forward rates are not merely some abstract expectation. Market professionals can lock in any of these forward rates by taking offsetting positions on securities maturing on the front end and back end of the forward period of concern.

¹⁷ Curry and Hasterok *Report*, p. 20, "This amount assumes ... a replacement yield of 0.65%."

¹⁸ Curry and Hasterok *Report*, p. 19, "The projected interest earned is subtracted from the interest that should have been earned at the Guaranteed Rate under the RFA, and then the differential is discounted back to 25-Mar-2009 using the replacement yield."

¹⁹ Curry and Hasterok *Report*, p. 3.

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Forward rates of interest define what the market is requiring today to fund long-term forward or future commitments. Current short-term rates of interest do not indicate what the market is requiring today to fund long-term forward or future commitments. That is why knowledgeable finance professionals use forward rates to value forward commitments.

3.4. Forward Rates and Expected Future Rates of Interest

There are two questions that arise in this dispute that are integrally related. The first is whether forward rates of interest should be used in valuing forward commitments. The answer is yes. Valuing projected cash flows by some other method that is at variance with the forward rates is inconsistent with finance theory and practice, and would subject investors using such alternative methods to huge losses against arbitrageurs. The second is whether forward rates of interest should be used in projecting the cash flows due under forward commitments. The answer, again, is yes. There are two reasons that this is so. First, the traded values of floating rate financial instruments reflect projected cash flows based on forward rates. This, in turn, affects the cost that a dealer must incur when structuring an instrument such as a forward commitment. If dealers were to project any other cash flows, they would derive values inconsistent with traded/market values and open themselves to huge losses when trading against informed investors and arbitrageurs.

Second, forward rates of interest contain the best aggregated information regarding the market's expectation of future rates of interest. Accordingly, they have relevance in developing expected future net cash flows to be discounted in valuing future commitments. This will be discussed later. I will refer to these two issues as the "discount rate" issue and the "cash flow" issue, respectively, in my discussion that ensues. They work together because determining a "Termination Value" requires projected cash flows and appropriate discount factors applied to those cash flows to ascertain their present value. Both of these elements depend upon the term structure of forward rates of interest, which is readily determinable by financial market participants on a daily (and more frequent – virtually continuous) basis.

3.5. Discount Rate

Messrs. Curry and Hasterok entitle a section of their *Report* as follows: "Inapplicability of Forward Curves." They explain that "The major difficulty in using forward curves to calculate replacement yields is the inability of TSA to actually transact in these products under economic terms that mimic the existing terms of the RFA."²⁰ According to Messrs. Curry and Hasterok, any replacement security would need to offer a similar periodic payment, or its equivalent in market or present value terms. The present value of such an instrument, however, does not depend upon the ability of any party valuing the instruments to replicate the terms thereof. The fact that any particular investor cannot afford or is not permitted to hold a particular instrument has no bearing upon its market or present value, which is established independent of any given party. For example, I cannot personally afford to buy

²⁰ See Curry and Hasterok *Report*, p. 13.

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and undertake the necessary market positions to synthetically create an instrument that would return similar payments, yet that does not affect the value of such an instrument.

It is well established in finance theory and practice that the value of a fixed rate forward commitment can be determined by discounting the associated cash flows by the forward interest rates applicable to the timing of those cash flows. You will get similar values if you discount the cash flows by their associated spot rates of interest.²¹ Likewise, if you properly calibrate the average paths of “short rates” (an expression used to denote possible short-term future rates of interest that might ensue over time), you will also arrive at the same value. Indeed, if using possible future interest rate paths for discounting fixed cash flows gives you any value other than what is obtained using discount factors based on forward or spot rates of interest, then you know that your valuation model is improperly calibrated. This equality is ensured by the economic forces of arbitrage, which impose this discipline upon market prices and quickly erase economically significant pricing deviations.²²

In the figures below, I show the daily spot rate interest curves and forward rate interest curves that were derived from U.S. Treasury zero-coupon bonds priced throughout 2009, including March 25, the valuation date used by Messrs. Curry and Hasterok. In each figure, I have drawn an arrow pointing to the starting point of the interest rate curves applicable to the valuation date. The applicable maturities of the instruments from which the spot and forward rate curves were derived ranged from one month to thirty years for each day of the year. Four items are of note in these curves. First, throughout the year, the term structures of spot and forward interest are generally far above the constant 0.65% discount rate that Messrs. Curry and Hasterok assumed and used in their valuations.²³ Only the shortest-term rate

²¹ The discount factors based on spot rates (+1) are taken to a power reflecting their maturities, whereas the discount factors based on forward rates are derived by multiplying together the chain of all forward rates (+1) up to the maturity date. These produce exactly the same discount factors.

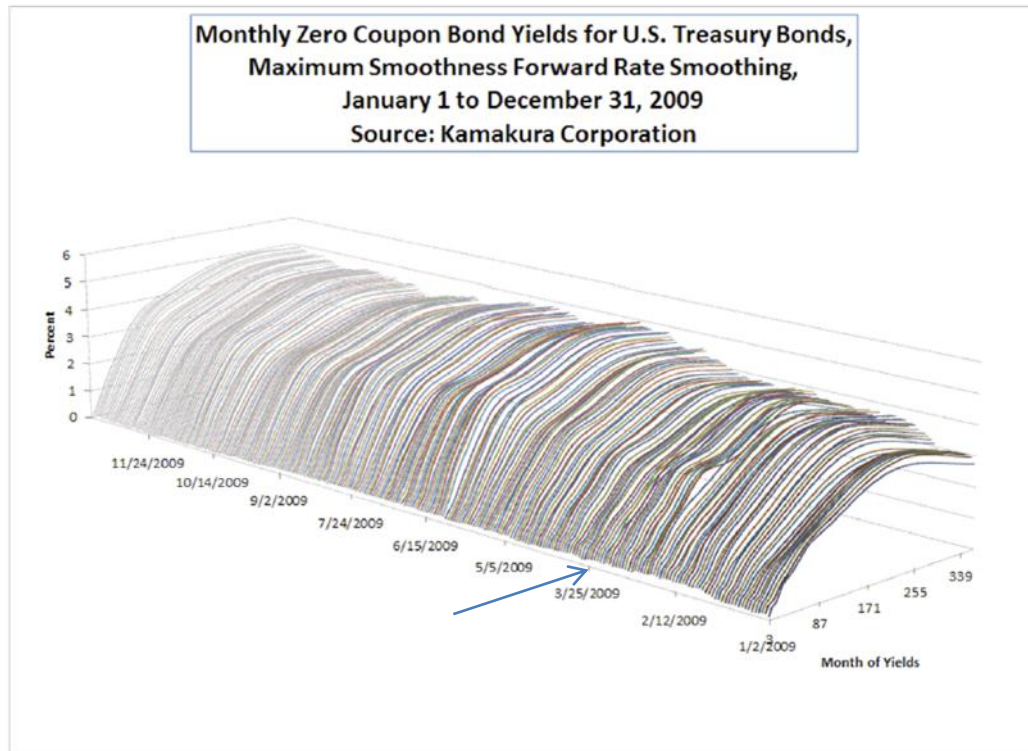
²² See David F. Babbel and Craig B. Merrill, *Valuation of Interest-Sensitive Financial Instruments*, SOA Monograph M-FI96-1, Society of Actuaries, 1996 and revised ed. 2000, Chapter 2; Anthony M. Santomero and David F. Babbel, *Financial Markets, Instruments & Institutions*, 2nd Ed., McGraw-Hill Irwin, 2001, Chapter 7. Note that the valuation models described by these two textbooks did not originate with the authors, but the textbooks merely reflect standard finance theory and practice.

²³ It has been known for more than a century that it is appropriate to discount cash flow streams emanating from securities by different rates that reflect their timing. For example, Professor Irving Fisher of Yale University noted in *Appreciation and Interest*, The MacMillan Company, New York: 1896, p. 91: “The rate for a loan to be contracted one year hence and payable two years hence is the agio (reckoned to-day) of next year’s goods over the goods of the succeeding year and so on. The rate for a loan contracted to-day and payable two years hence is the ‘actuarial average’ of the two previous rates. There is no reason why these three rates and others constructed in the same manner should not be all different. We thus reach a multiple theory of interest. Our results are, first, that different standards have in general different rates of interest; secondly, that of the numerous standards thus possible a different one is ‘absolute’ for each individual; thirdly, that in each standard there will be a different rate for different periods of time.” <https://ia600304.us.archive.org/6/items/appreciationinte00fish/appreciationinte00fish.pdf>. Some 34 years later he elaborated on his findings in *The Theory of Interest*, The MacMillan Company, New York: 1930, p. 71: “There is a see-saw between the rates on short term and long term loans. That is, if the short term rate is greatly above the long

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Figure 3: Spot Interest Rate Curves in 2009



Source: Daniel T. Dickler, Robert A. Jarrow and Donald R. van Deventer, *Inside the Kamakura Book of Yields*, Volume II: *A Pictorial History of 50 Years of U.S. Treasury Zero Coupon Bond Yields*, September 26, 2011; and *A Pictorial History of 50 Years of U.S. Treasury Forward Rates*, September 13, 2011.

term, it is likely to fall, or if greatly below, to rise. The long term rates thus set a rough norm for the short term rates, which are much more variable." http://files.libertyfund.org/files/1416/Fisher_0219.pdf

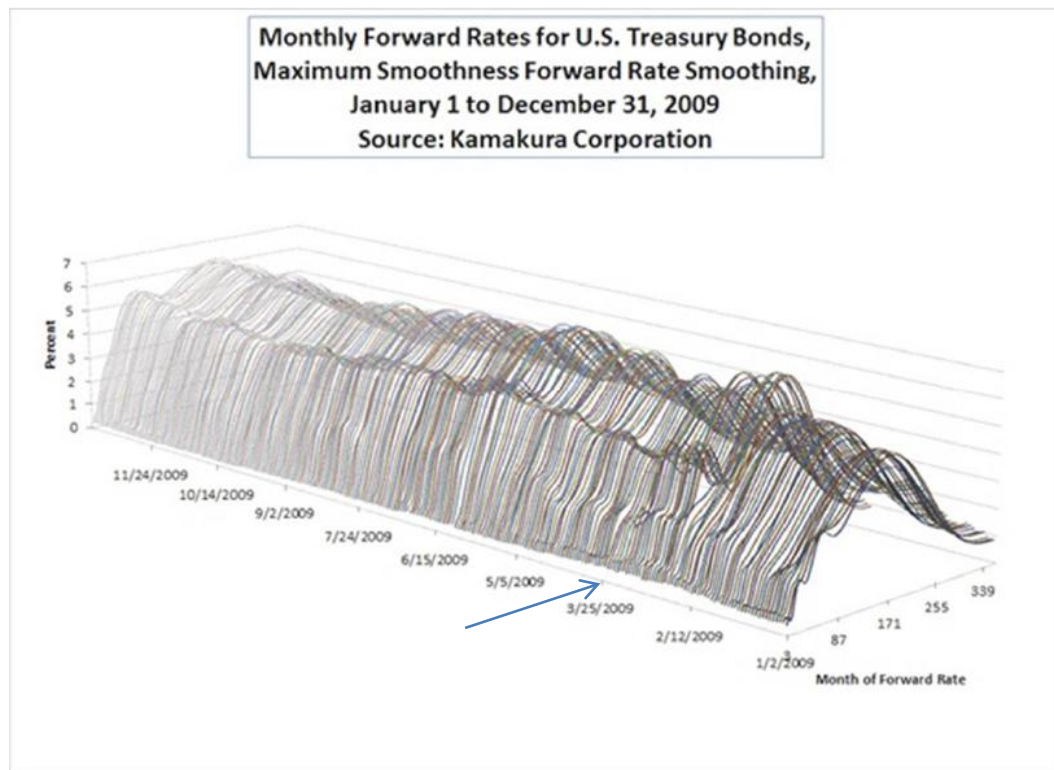
Babbel and Merrill *op cit* pp. 22-24 proved that the use of a single discount rate is valid only when it reflects a dollar-duration-weighted average of the applicable spot or forward rates of interest. It has been repeatedly noted in the finance literature that a unitary discount rate can only be properly used for discounting cash flows when you already know the security's value. But in the case at hand, the Expert Report of Messrs. Curry and Hasterok presents a value by using a discount rate that cannot be judged appropriate unless they already know the value! As Carlton and Cooper pointed out in "Estimation and Uses of the Term Structure of Interest Rates," *Journal of Finance* 31:4 (September 1976), p. 1068: "As many people have shown, the concept of yield to maturity, i_b , is an ambiguous concept. For a conventional bond (if not for some hybrid financial contracts or real asset purchases), the expected cash flow pattern implies a unique i_b as a solving-or internal-rate of return. Its economic meaning is moot, however, inasmuch as reinvestment of intermediate cash flows at the solving rate is implied. To borrow a concept from the capital budgeting literature, the price of an asset equals its present value only in the sense that its cash flows have been discounted at the market's return requirements It is true that associated with each bond is a derived [yield to maturity], but that does not give us license to say that it is a market-required rate, exogenous to the individual bond in question."

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applicable to the briefest of commitments even approaches their assumed rate, yet the commitment by LBSF is assumed to extend over some 23 years from the Valuation Date. Second, you can see that a different rate is applicable to each cash flow, depending on its timing. Third, you can see that the applicable market rates change from day to day over the entire year. Fourth, the forward rates are more variable than the spot rates, which are geometric averages of the forward rates and therefore reflect smoothing.

Figure 4: Forward Interest Rate Curves in 2009



Source: Daniel T. Dickler, Robert A. Jarrow and Donald R. van Deventer, *Inside the Kamakura Book of Yields*, Volume II: *A Pictorial History of 50 Years of U.S. Treasury Zero Coupon Bond Yields*, September 26, 2011; and *A Pictorial History of 50 Years of U.S. Treasury Forward Rates*, September 13, 2011.

It is also important to note that the spot rates of interest exceed 4% at some maturities, and the forward rates of interest reach 5.43% over certain maturity ranges, as confirmed in the table that follows. Compare these discount rates to the constant 0.65% discount rate assumed by Messrs. Curry and Hasterok. Note also that for each 1% that they understate the appropriate discount rate, it produces an approximately 10% overstatement of the fixed leg of the swap, other things being equal. Because their average discount rate is greatly understated, it means that they have correspondingly substantially overstated the Termination Amount, other things being equal. But other things are not equal, as I will show in the next section. Finally, the spot and forward rates shown here were derived from Treasury bonds, which are more liquid and have less credit risk than the rates of certain

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eligible investments that Lehman was permitted to deliver to TSA under the RFA. Accordingly, the applicable discount rates for valuing the Termination Amount would be significantly higher than those shown in the figures below, meaning that Messrs. Curry and Hasterok have overstated the Termination Amount by an even greater amount than implied by simply looking at the Treasury discount factors below.

As stated earlier, the applicable spot rates and/or forward rates for discounting the projected cash flows can be obtained from numerous on-line sources, such as Bloomberg, that are updated continuously throughout the day. Numerous financial institutions such as Goldman Sachs and Bank of America Merrill Lynch also continuously update their term structures of spot and forward rates of interest. Market professionals use these easily accessible sources like Bloomberg or their own proprietary ones every day. Moreover, the U.S. Federal Reserve Board publishes daily spot rate and forward rate term structures of interest applicable to Treasury securities.²⁴ Again, either the spot rates or the applicable sequence of forward rates can be used to discount any given cash flow and produce the same result. The U.S. Federal Reserve Board has published the following information regarding the spot and forward rates of interest (presented here in annualized format) for the ensuing 23 years:

Table 1: US Treasury Spot and Forward Rates for March 25, 2009

Year	Spot Rates of Interest	Forward Rates of Interest
1	0.66%	0.92%
2	0.95%	1.57%
3	1.27%	2.28%
4	1.61%	2.97%
5	1.94%	3.61%
6	2.27%	4.16%
7	2.57%	4.61%
8	2.84%	4.96%
9	3.09%	5.20%
10	3.31%	5.36%
11	3.50%	5.43%
12	3.66%	5.43%
13	3.79%	5.38%
14	3.90%	5.27%
15	3.99%	5.13%
16	4.05%	4.95%
17	4.10%	4.76%
18	4.13%	4.55%

²⁴ Refet S. Gürkaynak, Brian Sack, and Jonathan H. Wright, *The U.S. Treasury Yield Curve: 1961 to the Present*. Finance and Economics Discussion Series, Divisions of Research & Statistics and Monetary Affairs, Federal Reserve Board, Washington, D.C., 2006-28.

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Year	Spot Rates of Interest	Forward Rates of Interest
19	4.15%	4.34%
20	4.15%	4.12%
21	4.14%	3.90%
22	4.13%	3.69%
23	4.10%	3.48%

The term structures of interest can be based on Treasuries of various countries, LIBOR, commercial paper, agency securities, municipal securities, and other instruments. While numerous programs and different approaches exist to compute and display these spot and forward rates, they tend to produce remarkably consistent estimates.²⁵ If the appropriate yield curves are not publicly available, they can be estimated through standard techniques.

TSA is relying upon the Expert Report of Messrs. Curry and Hasterok to justify the amount of its proof of claim that it has filed in the Lehman bankruptcy proceeding. Such reliance is misplaced because Messrs. Curry and Hasterok assumed a constant 0.65% discount rate in calculating the purported “loss” of TSA. Such an assumption conflicts with both finance theory and practice, and its use results in significantly inflating TSA’s bankruptcy claim.

3.6. Cash Flows

In determining the value of a financial contract, such as the RFA, you need to have estimated cash flows and appropriate discount rates. I have addressed the discount rate issue and now turn to the cash flows. Messrs. Curry and Hasterok have extended their cash flow “estimates” out 23 years. In reality, their “estimates” are not really estimates at all – rather, they are merely based on a single contrived illustrative scenario. They completely ignore the rich economic information that is readily available to them, assuming instead that interest rates will remain at a constant 65/100s of 1 percent until 2032. Never mind that current interest rates are at historic lows.

There are four main theories of the shape of the term structure of interest rates, and all of them embed expectations regarding the future levels of interest rates. These theories, or explanations of interest rate differences across the maturity spectrum, all predict that we will not remain at the current historic lows until 2032. Each theory brings insight into the shape of the term structure of interest, and expectations regarding the future are an important feature of each of them. The theories go by the names of Pure Expectations Theory, Local Expectations Theory, Liquidity Preference (or Term Premium) Theory, and Preferred Habitat Theory. None of the insights from these financial theories are reflected in the “expectations” of Messrs. Curry and Hasterok.

In my view, it is not appropriate to completely ignore the information contained in the term structure of interest regarding market expectations of future interest rates when developing

²⁵ Bongju Song, “An Empirical Study of the Yield Curve with GovPX Data.” Updated article taken from Chapter 2 of his PhD dissertation, Texas A&M University, February 2014.

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cash flow forecasts that are explicitly linked to future interest rates. This cannot be supported by sound financial theory or practice.

On the other hand, but equally linked to the term structure of interest rates, the value of a floating rate instrument already embeds market information about the term structure of interest rates, and more importantly, reflects the market price of making forward commitments. Messrs. Curry and Hasterok have simply ignored the fact that to make forward commitments, the providing institution (LBSF) will have to incur the market costs of doing so, and those market costs are reflected in the term structure of interest rates. Imagine what price the floating leg of an interest rate swap would command in the marketplace if it did not float over the next 23 years above 0.65% but was fixed for that entire period when the going rate for a fixed coupon instrument was several times higher! Messrs. Curry and Hasterok simply subtract the 0.65% rate from the 4.484% fixed rate that was promised and base their projected cash flows over the ensuing 23 years on the 3.834% difference.

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4. Concluding Comments

In calculating TSA's loss as a result of the termination of the RFA, Messrs. Curry and Hasterok opine that, "No Dealer will replace TSA's lost economics under the RFA by entering into a replacement RFA transaction with TSA at any time from March 2009 onward."²⁶ Their solution is to calculate a Termination Amount on the purported difference between what LBSF/LBHI would have paid to TSA from September 2008 to the assumed end of the arrangement in May 2032 at the guaranteed rate under the RFA and the amount TSA is projected to realize if it had been able to enter into a very specifically devised replacement arrangement. Using this approach, Messrs. Curry and Hasterok calculated a Termination Amount of \$37.5 million that is purportedly owed to TSA by LBSF/LBHI.

Crucially, however, Messrs. Curry and Hasterok have assumed that the current, historically low interest rate environment will continue to prevail during the entire approximately 23-year period from March 2009 through May 2032. Accordingly, for purposes of their Termination Amount calculation, Messrs. Curry and Hasterok assume that (1) TSA would only earn interest at a rate of 0.65% during that period and (2) the discount rate should also be the same constant 0.65% over the entire period. Put very simply, their calculation vastly inflates the projected net cash flows that would be due under the agreement and then compounds the error by discounting that inflated net cash flow stream by historically low interest rates that do not reflect the term structure of interest rates prevailing in the market.

Neither of these assumptions is supported to any degree by established financial theory or practice. Using a constant 0.65% discount rate ignores the proper practice for computing present values that I have taught in hundreds of classes over my academic career. While current forward interest rates do not unerringly predict future interest rates, they do reflect the best current information on where market participants think interest rates are heading. To ignore the information in future rates and assume a constant 0.65% replacement yield and discount rate for the RFA to calculate the Termination Amount is totally unjustified.

By ignoring proper valuation methods, Messrs. Curry and Hasterok have distorted their calculation by orders of magnitude.



David F. Babbel

February 24, 2014

Dated

²⁶ Curry and Hasterok *Report*, p. 2.

February 24, 2014

Exhibit 1

Curriculum Vitae of Professor David F. Babbel

DAVID F. BABBELSenior Advisor in Finance Group
Director of Insurance Economics PracticeEmeritus Professor, The Wharton School
University of PennsylvaniaPostdoctoral Fellow, Risk and Insurance
The Wharton School
University of PennsylvaniaPostdoctoral Studies, Financial Theory
The Haas School of Business
University of California at BerkeleyPhD Finance
University of FloridaPhD Certificate of Latin American Studies
MBA Finance and International Finance
University of FloridaBA Economics and Philosophy
Brigham Young University and
George Mason University

Prior to joining Charles River Associates as a senior advisor in the Finance Group, Dr. Babbel was a senior financial economist in the Financial Sector Development Department of the World Bank, and a vice president in the Financial Strategies Group, Fixed Income Division as well as leader of the Insurance Services Group in the Pension and Insurance Department of Goldman Sachs. With over one hundred articles and publications to his credit, along with a number of books and monographs, Dr. Babbel is an expert in the fields of finance, investments, risk management, insurance, and international finance. His specialties within these fields are fixed income securities, asset/liability management, valuation, life insurance, and annuities. In addition, Dr. Babbel is Emeritus Professor at The Wharton School at the University of Pennsylvania, having previously served as a finance and international finance professor at the Haas School of the University of California at Berkeley. During his more than 25-year career as an educator, Dr. Babbel has taught courses in finance, investments, fixed income, insurance, and international finance at the undergraduate, graduate, doctoral, and executive level. He has also been invited to speak before many conferences, conventions, and seminars, both in the United States and abroad.

ACADEMIC APPOINTMENTS2011–Present *Emeritus Professor*, The Wharton School, University of Pennsylvania1998–2010 *Full Professor of Insurance and Risk Management and Full Professor of Finance*
The Wharton School, University of Pennsylvania1985–1997 *Associate Professor of Finance and Associate Professor of Insurance*
The Wharton School, University of Pennsylvania1978–1984 *Assistant Professor of Finance and Insurance and Assistant Professor of Int'l Finance*,
The Haas School, University of California at Berkeley

NONACADEMIC APPOINTMENTS

- 2006–Present *Senior Advisor*, Finance Group and Insurance Economics Practice
Charles River Associates, New York City, NY
- 1995 *Senior Financial Economist*, The World Bank,
Financial Sector Development Department, Washington, D.C.
- 1987 Vice President, Goldman, Sachs, and Company, Pension and Insurance Department,
New York, NY. After returning to Wharton, continued on as a Senior Advisor from
1988-1992 in Fixed Income Division, Financial Strategies, Capital Markets, Mortgage
Securities, and Goldman Sachs Asset Management divisions.
- 1976–1977 *Financial Economist*, Brazilian Capital Market Institute, Financial Research
Division, Rio de Janeiro, Brazil

Consultant and Expert Witness:

U.S. Treasury Department; Federal Reserve System; U.S. Office of Management and
Budget; Federal Trade Commission; Commodities Futures Trading Commission;
U. S. Dept. of Justice; Federal Bureau of Investigation; U.S. Dept. of Labor;
Resolution Trust Corporation; several distinguished private law firms

Financial Consulting:

Large insurers (U.S. and abroad, 1978-2013), have done asset/liability management and
other consulting projects and training for 25 large insurers

Accenture, Booz Allen Hamilton, PricewaterhouseCoopers, Ernst and Young, KPMG,
various investment and insurance-related assignments (1989-2009)

NERA (New York, 2000-2002), Special Consultant on financial valuation, asset/liability
management, investments, pensions and insurance

Goldman, Sachs and Company (New York, 1986-92), investigation of fixed income
financial strategies and financial risk management techniques; consultation with
major insurance and pension clients of the firm

The Frank Russell Company (Tacoma, 1994-5), develop fixed income investment
strategies and valuation models for their pension and insurance clients

J. P. Morgan Guaranty (New York, 1989), developed a program to hedge against
clustered bank loan defaults

G. E. Capital (Schenectady, N.Y., 1997-2001), assist in the development of valuation
software for individual and group annuity insurance contracts

I.B.M. (New York, 1987-97), executive training on asset/liability management for financial
institutions; computer applications for insurance companies; strategic planning on
the future of the insurance industry

The World Bank (Washington, D.C., 1989-present), elaboration of an options approach
toward insuring against default on sovereign debts; participated in programs for
training central bankers to manage financial risks; developed asset allocation
strategies for insurers and pension funds in developing countries

Winklevoss Pension Actuarial Consultants (Greenwich, Ct., 1997), created new valuation
software for pension assets and liabilities; model employs two stochastic factors

for Treasury bond valuations and achieves closed-form solutions, and provides n-factor simulations for other investment categories

Shane Chalke, Inc. (Chantilly, Va., 1989), assisted in the design of new actuarial valuation software for life insurance assets and liabilities

International Monetary and Financial Institute (San Francisco, 1984-5), analysis of inflation-indexed bonds; creation of synthetic options for hedging oil risk

CSX (Richmond, 1990) and Sealand (Metropark), developed optimal foreign currency management program for exposures from international shipping

National Development Bank of Taiwan (Taipei, 1982), executive development on international sourcing of capital; Eurobond, Eurodollar, and Asian dollar markets

Bankers Institute of the Republic of China (Taipei, 1982-3), development of off-shore banking expertise among commercial bank executives

Johnson & Higgins Brokerage (San Francisco, 1981-3), development of pension risk management strategies involving duration analysis, enhanced immunization

AEtna Life and Casualty (Hartford, 1990-1), fair rate of return modeling for New Jersey property/casualty business lines; California Proposition 103 research

U.S. Department of the Treasury (Washington, D.C., 1981), analysis of inflation-indexed government and private bonds; report on prospects for default on Brazilian loans

Morrison - Knudsen Engineering (Boise, 1980), analysis of Argentine hydroelectric power bidding strategies using inflation-indexed contracts

United Nations (New York, 1989-91), participated in programs for training ministries of finance and central bankers to manage financial risks

Lehman Brothers (New York, 1992), helped train their staff for insurance company investment management and mutual fund sales

Milliman & Robertson, Inc. (Seattle, 1994), research on investment trust business conducted for Nippon Life Insurance

AWARDS AND RECOGNITIONS, MEMBERSHIPS

Critical Review of the U.S. Actuarial Profession (CRUSAP) Advisory Panel, 2005–2006

William G. Whitney Award for Distinguished Undergraduate Teaching, 2003

Wharton Financial Institutions Center Senior Fellow, 1995-Present

Annual Prize for best paper published in the *North American Actuarial Journal*, 2002

Valuation Tools Working Group, American Academy of Actuaries Valuation Task Force, 1997–2002

Graham and Dodd Award of Excellence, Association for Investment Mgmt. and Research, 1997

Society of Actuaries Research Grant, 1992–1996

Anheuser Busch Term Chair, 1987–1990

Award for Best Feature Article, 1989, American Risk and Insurance Association
Prochnov Foundation for Banking Studies Research Grant, 1988
CPCU—Harry J. Loman Foundation Research Fellowship, 1986
Honorary Master of Arts Degree, University of Pennsylvania, 1985
Huebner Foundation Postdoctoral Fellowship, The Wharton School, 1984–1985
Award for Best Communication, 1983, American Risk and Insurance Association
Regents of California Junior Faculty Fellowship, 1983–1984
Fulbright Fellow, U. S. Office of Education, 1977
Fulbright—Hays Fellowship, U. S. State Department, 1976
Various Academic Scholarships, Fellowships, Research Grants
Omicron Delta Epsilon (International Honor Society in Economics)
Beta Gamma Sigma (National Scholastic Honor Society of Business and Administration)
Member, American Finance Association, American Risk and Insurance Association
Past member, American Economics Association, Academy of International Business
Listed in Who's Who in the World, Who's Who in America, Who's Who in the East, Who's Who in the West, Who's Who in Finance and Industry, Men and Women of International Distinction, Men of Achievement in International Business, Emerging Leaders of America, and Who's Who in Business Higher Education (various volumes and dates)

RESEARCH AND PUBLICATIONS

"Buy Term and Invest the Difference Revisited." (with Oliver D. Hahl) Working Paper, February 2014.

"Scenario Analysis in the Measurement of Operational Risk Capital: A Change of Measure Approach." (with K. Dutta) Wharton Financial Institutions Center, *Journal of Risk and Insurance*, forthcoming March 2014.

"Evaluating Pension Insurance Pricing." In Technical Review Panel for the PIMS (The Pension Insurance Modeling System used by the Pension Benefit Guaranty Corporation) Model: Final Report. Pension Benefit Guaranty Corporation (PBGC), Pension Research Council Working Paper WP2013-16. Philadelphia, PA: Pension Research Council, September 2013.

"Staggered Annuitization: Dealing with the Top 10 Financial Challenges." *NAFA Annuity Outlook*, lead article, July/August 2013.

"Stable Value Funds: Performance to Date – Part I." (with M. Herce) *Retirement Income Journal*, March 2013.

"Stable Value Funds: Performance to Date – Part II." (with M. Herce) *Retirement Income Journal*, March 2013.

"Economic Analysis of Insurance Products in Workplace Benefit Programs in the U.S." (with M. Meyer, M. Herce, J. Dermody, N. Vasavada) White Paper, June 2011.

"Real World Index Annuity Returns." (with J. Marrion and G. VanderPal) *Journal of Financial Planning*, March 2011.

"Stable Value Funds: Performance to Date." (with M. Herce) Wharton Financial Institutions Center Working Paper, January 2011.

"A Note on Scenario Analysis in the Measurement of Operational Risk Capital: A Change of Measure Approach." Wharton Financial Institutions Center, September 2010.

"Stable Value Funds: Performance from 1973 through 2008." (with M. Herce) Wharton Financial Institutions Center, September 2009.

"Statistical String Theory for Courts: If the Data Don't Fit..." (with J. Strickler and R. Sears) *Berkeley Electronic Press*, July 2008; *Journal of Legal Technology Risk Management*, Summer/Fall 2009.

"Measuring the Tax Benefit of a Tax-Deferred Annuity." (with R. Reddy) *Journal of Financial Planning*, October 2009.

"Part Two of the Interview with Wharton Professor David Babbel on Fixed Indexed Annuities." (with David Cochrane) *Annuity Digest*, July 27, 2009.

"An Interview with Wharton Professor David Babbel on Fixed Indexed Annuities – Part One." (with David Cochrane) *Annuity Digest*, July 26, 2009.

"Review of Lifetime Financial Advice: Human Capital, Asset Allocation and Insurance." *Journal of Pension Economics and Finance*, October 2008.

"Lifetime Income for Women: A Financial Economist's Perspective." *Personal Finance*, Wharton Financial Institutions Center, July 2008.

"Investing Your Lump Sum at Retirement." (with C. Merrill) *Personal Finance*, Wharton Financial Institutions Center, July 2006. Also published by the American College, Bryn Mawr, PA and also published as a chapter in the *New York Life Retirement Income Guide*, 2007, 2010.

"Review of the Calculus of Retirement Income: Financial Models for Pension Annuities and Life Insurance." *Journal of Risk and Insurance*, December 2007.

"A Closer Look at Stable Value Funds Performance." (with M. Herce) Wharton Financial Institutions Center, September 2007.

"Insuring the Uninsurable II." *The Role of Insurance and Management of Risk in the 21st Century*. The Barbon Institute, Cambridge, 2006.

"Rational Decumulation." (with C. Merrill) Wharton Financial Institutions Working Paper, June 2006.

"Extracting Probabilistic Information from the Price of Interest Rate Options: Tests of Distributional Assumptions." (with K. Dutta) *Journal of Business*, May 2005.

"Real and Illusory Value Creation by Insurance Companies." (with C. Merrill) *Journal of Risk and Insurance*, March 2005, lead article.

"The Price Pressure Hypothesis and Off-The-Run Treasury Bonds." (with C. Merrill, M. Meyer, and M. DeVilliers) *Journal of Financial and Quantitative Analysis*, September 2004.

"Fair Value of Liabilities: The Financial Economics Perspective." (with J. Gold and C. Merrill) *Asset and Liability Management Tools*, Risk Waters, London, 2003.

"Fair Value of Liabilities: The Financial Economics Perspective." (with J. Gold and C. Merrill) *North American Actuarial Journal*, January 2002. Awarded Annual Prize for best paper published in the *North American Actuarial Journal*.

"Fair Value of Liabilities: The Bullet GIC as an Example." (with J. Gold and C. Merrill) *Risk and Rewards*, Finance Section, Society of Actuaries, lead article, January 2001.

"Financial Engineering and Structured Products." *Proceeding of the Conference of Consulting Actuaries*, Volume 50, Summer 2001.

Financial Markets, Instruments and Institutions. (with A. Santomero) McGraw Hill-Irwin, 2nd ed., 2001.

"Asset/Liability Management for Insurers in the New Era: Focus on Value." *Journal of Risk Finance*, lead article, October 2001.

"Inverse Floaters and the Income Stability of a Debt Securities Investment Portfolio." (with C. Ma and B. Ni) *Journal of Portfolio Management*, Winter 2000.

Valuation of Interest-Sensitive Financial Instruments. (with C. Merrill) Society of Actuaries, Wiley Publishers, revised ed., 2000.

"An Analysis of the Financial Risk Management Process used by Life Insurers." (with A. Santomero) *Changes in the Life Insurance Industry: Efficiency, Technology and Risk Management*, Kluwer, Norwell, MA., 1999.

"Effective and Ineffective Duration Measures for Life Insurance." *Investment Management for Insurers*, Frank J. Fabozzi Associates, 1999.

"Financial Performance Measurement for Insurers." (with R. Stricker and I. Vanderhoof) *Investment Management for Insurers*, Frank J. Fabozzi Associates, 1999.

Investment Management for Insurers. (with F. Fabozzi) Frank J. Fabozzi Associates, 1999.

"Risk Management by Insurers: An Analysis of the Process." (with A. Santomero) *Investment Management for Insurers*, Frank J. Fabozzi Associates, 1999.

"Toward a Unified Valuation Model for Life Insurers." (with Craig B. Merrill) *Changes in the Life Insurance Industry: Efficiency, Technology and Risk Management*, Kluwer, Norwell, MA., 1999.

"The Components of Insurance Firm Value, and the Present Value of Liabilities." *Investment Management for Insurers*, Frank J. Fabozzi Associates, 1999.

"Insurer Surplus Duration and Market Value Revisited." (with K. Staking) *Journal of Risk and Insurance*, March 1998.

"Economic Valuation Models for Insurers." (with C. Merrill) *North American Actuarial Journal*, lead article, July 1998.

"Saiken no Hasankiken to Kakaku Kando." (with C. Merrill and W. Panning) *Security Analysts Journal of Japan*, October 1998.

"Financial Valuation of Insurance Liabilities." *Fair Value of Insurance Liabilities*, I. Vanderhoof and E. Altman, eds., Kluwer, 1998.

"An Analysis of the U.S. Department of Labor Proposed Regulation Relating to General Account Pension Contracts." (with M. Meyer) Washington, D.C., March 1998.

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"Insuring Sovereign Debt Against Default." *Discussion Paper*, Financial Sector Development Department, The World Bank, August 1996.

"Teaching Interest Rate Contingent Claims Pricing." (with C. Merrill and J. Zacharias) *Journal of Financial Education*, section lead article, December 1996.

"Interest-Rate Option Pricing Revisited." (with C. Merrill) *Journal of Futures Markets*, lead article, December 1996.

"Capping the Interest Rate Risk in Insurance Products." (with P. Bouyoucos and R. Stricker) *The Handbook of Fixed-Income Options*, Frank J. Fabozzi, ed., Irwin Press, 1996.

"Default Risk and the Effective Duration of Bonds." (with C. Merrill, and W. Panning) *The Strategic Dynamics of the Insurance Industry*, Ed Altman and Irwin T. Vanderhoof, eds., Irwin Press, 1996.

"Report on the Reform of New York State Insurance law Section 4228." (with M. Meyer) New York Assembly, Albany, October 1996.

The World Bank Primer on Reinsurance. (with D. McIsaac) World Bank Monograph, 1995.

"The Liability Maze: The Impact of Liability Law on Safety and Innovation." P. Huber and R. Litan, eds., book review, *Journal of Risk and Insurance*, March 1995.

"The Relation between Capital Structure, Interest Rate Sensitivity, and Market Value in the Property-Liability Insurance Industry." (with K. Staking) *Journal of Risk and Insurance*, December 1995.

"Asset-Liability Matching in the Life Insurance Industry." *The Financial Dynamics of the Insurance Industry*, E. Altman and I. Vanderhoof, eds., Irwin Press, 1994.

"A Modern Approach to Performance Measurement for Insurers." (with R. Stricker and I. Vanderhoof) *Operations Research Models in Quantitative Finance*, Rita L. D'Ecclesia and Stavros A. Zenios, eds., Physica-Verlag, lead chapter, 1994.

"Misadventures in Duration." *Risk and Rewards*, Finance Section, Society of Actuaries, lead article, August 1994.

"A Perspective on Model Investment Laws for Insurers." *C.L.U. Journal (Journal of the American Society of Chartered Life Underwriters)*, September 1994.

"An Economic Approach to Valuation of Single Premium Deferred Annuities." *Financial Optimization*, S. Zenios, ed., Cambridge University Press, 1993.

"Measuring the Interest Rate Risk of Property/Casualty Insurer Liabilities." (with David R. Klock) *Insurance, Risk Management, and Public Policy*, S. Gustavson and S. Harrington, eds., Kluwer Press, 1993.

An Insurance Primer: Review of the U.S. Insurance Industry, Market Structure, Products, Asset Need. (with D. Klock) Phillips Institute, 1993.

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"Generalized Put-Call Parity." (with L. Eisenberg) *Journal of Financial Engineering*, lead article, December 1992.

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"Estimating Market Value of Loss Payments of Property/Liability Insurance Companies Using Modern Valuation Technology." (with J. Choi) Working Paper, Wharton School, 44 pages, August 1992.

"Forecasting Property/Casualty Loss Payments and the Influence of Inflation and Interest Rates." (with J. Choi) unpublished report for Goldman Sachs, 68 pages, April 1991.

"The Financial Solidity of Life Insurance Companies." (with D. Klock) *Society Page*, American Society of C.L.U. and Ch.F.C., May 1991.

"It Pays to Practice A/L M." (with K. Staking) *Best's Review*, Property/Casualty Edition, May 1991.

"Performance Measurement for Insurers." (with R. Stricker and I. Vanderhoof) *Financial Institutions Research*, Goldman Sachs, October 1990.

"Valuation of Interest-Sensitive Cash Flows: The Need, The Technologies, The Implications." *Record: Society of Actuaries*, June 1990.

"Insurance for Clustered Credit Risks in Banking." *The Prochnow Reports*, Graduate School of Banking, University of Wisconsin, Madison, 1989.

"The Demand for Life Insurance: A Portfolio Choice." (with L. Han, and J. Outreville) unpublished manuscript, 29 pages, April 1989.

"Optimal Insurance of the Common Form Under Moral Hazard." (with J. Dermody) unpublished manuscript, 30 pages, March 1989.

"The Market Reward for Insurers that Practice Asset/Liability Management." (with K. Staking) *Financial Institutions Research*, Goldman Sachs, November 1989.

"Capping the Interest Rate Risk in Insurance Products." (with P. Bouyoucos and R. Stricker) *Fixed-Income Portfolio Strategies*, F. Fabozzi, ed., Irwin Professional Publishing, 1989.

"Insuring Banks against Systematic Credit Risk." *Journal of Futures Markets*, December 1989.

"Aspects of Optimal Multiperiod Life Insurance." (with E. Ohtsuka) *Journal of Risk and Insurance*, September 1989. Award for Best Feature Article, American Risk and Insurance Association.

"Assessing the Interest Rate Risk of Property and Casualty Companies." (with D. Klock and P. Polachek) *Insurance Perspectives*, Goldman Sachs, April 1988. Also published in *Proceedings of the International Insurance Seminar*, July 1988.

"Gazing Into the Insurance Future." *Record: Society of Actuaries*, June 1988.

"Capping the Interest Rate Risk in Insurance Products." (with P. Bouyoucos and R. Stricker) *Insurance Perspectives*, Goldman Sachs, March 1988.

"Not Whether But When." (with R. Jones) *Best's Insurance Review*, Life/ Health Edition, January 1988.

"Hokemgaisha No Tameno Shifan Fusai Kanri." (with R. Stricker and P. Polachek) *Insurance Perspectives*, Japanese Edition, Goldman Sachs, January 1988.

"Insurance Pedagogy: Executive Opinions and Priorities." (with D. Klock) *Journal of Risk and Insurance*, December 1988.

"Interest Rate Dynamics and the Term Structure." *Journal of Banking and Finance*, September 1988.

"Life Insurance Industry Trends in Asset/Liability Management." (with J. Lamm-Tennant) *Insurance Perspectives*, Goldman Sachs, November 1987.

"Asset/Liability Management for Insurers." (with R. Stricker) *Insurance Perspectives*, Goldman Sachs, 1st edition, May, 1987; 2nd edition, May 1989.

"Capping the Risks of Life Insurance Policy Loans and Lapses." *Insurance Perspectives*, Goldman Sachs, November 1986.

"The Pareto Optimal Design of Term Life Insurance Contracts." (with N. Economides) *Scandinavian Actuarial Journal*, spring 1985.

"The Price Elasticity of Demand for Whole Life Insurance." *Journal of Finance*, March 1985.

"The Term Structure of Interest Rate Volatility: A Binational Comparison." *Proceedings of the Academy of International Business*, 1985.

"A New Technique for Forecasting Short-Term Interest Rates?" *Berkeley Finance Quarterly*, January 1984.

"Real Immunization with Index-Linked Bonds." *Financial Analysts Journal*, November/December 1984.

"Duration and the Term Structure of Interest Rate Volatility." *Innovations in Bond Portfolio Management: Duration Analysis and Immunization*, G. Bierwag, G. Kaufman, and A. Toevs, eds., JAI Press, 1983.

"An Engel Curve Analysis of Gambling and Insurance in Brazil." (with K. Staking) *Journal of Risk and Insurance*, December 1983. Award for Best Communication, American Risk and Insurance Association.

"Determining the Optimum Strategy for Hedging Currency Exposure." *Journal of International Business Studies*, spring/summer 1983.

"A Capital Budgeting Analysis of Life Insurance Costs in the United States: 1950-1979." (with K. Staking) *Journal of Finance*, March 1983.

"Real Security: The Case for Inflation-Indexed Government Bonds." (with L. Helzel) *Barron's*, March 1, 1982.

"Exchange-Rate Fluctuations and Transaction Exposure in the Multinational Corporation." *I.E.E. Proceedings*, June 1982.

"Inflation, Indexation, and Life Insurance Sales in Brazil." *Journal of Risk and Insurance*, March 1981.

"Public Information and Investment Decisions." (with Y. Kwon) unpublished manuscript, 17 pages, September 1981.

"A Mathematical Note on Inflation, Regulation, and the Cost of Life Insurance." *Journal of Risk and Insurance*, March 1980.

"The Rise and Decline of Foreign Currency Options." *Euromoney*, September 1980.

"Inflation's Impact on Life Insurance Costs: Brazilian Indexed and Nonindexed Policies." *Journal of Risk and Insurance*, December 1979.

"Measuring Inflation Impact on Life Insurance Costs." *Journal of Risk and Insurance*, September 1979.

"Risk Management in Tropical Agriculture Systems." unpublished manuscript, 30 pages, March 1978.

Inflation and Indexation in Brazil: The Influence on Life Insurance. Ph.D. Dissertation, University Microfilms, Ann Arbor, 1978.

"Consumer Valuation of Life Insurance: Comment." *Journal of Risk and Insurance*, September 1978.

"Inflação Esperada e o Custo do Seguro de Vida." *Revista Brasileira de Mercado de Capitais*, lead article, May/August 1977.

"Monetary Correction in Brazil: Effect on Life Insurance." *Latinamericanist*, lead article, fall 1977.

"Governmental Disincentives on Agricultural Response to Demand-Developing Countries." *World Agricultural Highlights*, July 1974.

"On Measuring Skewness and Kurtosis in Short Rate Distributions: The Case of the U.S. Dollar London Inter Bank Offer Rates." (with K. Dutta) Wharton Financial Institutions Center, 2001.

"A Financial Analysis of the Executive Life Insolvency." Report to Federal District Courts in California, Louisiana, Texas, Maine, North Carolina, approx. 150 pages (sealed documents).

"A Financial Analysis of the First Capital Life and Fidelity Bankers Life Insolvencies." Report to Federal District Court of Southern California, approx. 600 pages (sealed documents).

PARTICIPATION IN CONVENTIONS AND SEMINARS

Invited Presentation, "Women and Risk: Myth or Market Opportunity?" Global Interdependence Center Women's Conference, Philadelphia, November 2013.

Invited Presentation, "Assessment of the PIMS Pricing Model." Technical Review Panel for the Pension Insurance Modeling System (PIMS) Model, *Pension Benefit Guaranty Corporation (PBGC)*, The Wharton School, University of Pennsylvania, Philadelphia, April 2013.

Keynote Speaker: "Financial Security for Working Americans: An Economic Analysis of Insurance Products in Workplace Benefits Programs." Protect 2011: Workplace Benefits and Financial Security Symposium, Washington, D.C., July 2011.

Keynote Speaker: "Stable Value Funds: Performance to Date." NYU-Stern Five Star Conference on Research in Finance (Yale, Columbia, Princeton, NYU, and Wharton), New York, January 2011.

Invited Presentation, "UnSupermodels and the Equity-Indexed Annuity." Retirement Income Products Executive Symposium. Individual Finance and Insurance Decisions (IFID) Centre of the Schulich School of Business, York University of Toronto, Ibbotson Associates, Morningstar, University of Chicago, November 2008. Also presented at Laval University, New York University, University of Pennsylvania.

Invited Presentation, "Statistical String Theory for Courts: If the Data Don't Fit..." *Atlantic Economic Association*, Villanova, September 2007 and *Applied Economics Seminar*, The Wharton School, March 2008 and *Finance Seminar*, Laval University, April 2008.

Keynote Speaker, "A Closer Look at Stable Investment Funds Performance." Stable Value Investment Association Conference, Charleston, April 2007.

Keynote Speaker, "Reinsurance Strategies for Emerging Markets." The Association for Colombian Insurers, Cartagena, Colombia, October 2002.

Keynote Speaker, "The Redington Centenary Lecture." *Institute of Actuaries*, London, May 2006.

Invited Presentation, "A/L Management for Life Insurance." *Contractual Savings Conference*, World Bank and IMF, Washington, D.C., May 2002.

Invited Presentation, "Insurers' Financial Risk Management Processes." *Global Issues in Insurance Regulation*, London, April 2002.

Invited Presentation, "Asset/Liability Management for Insurers in the New Millennium." *Asset and Liability Management: From Institutions to Households*, Nicosia, May 2001.

Invited Presentation, "Financial Engineering and the Actuarial Profession." *50th Conference of Consulting Actuaries*, Palm Desert, November 2000.

Invited Presentation, "Toward a Unified Valuation Model for Insurers." (with C. Merrill) *American Risk and Insurance Association*, Baltimore, August 2000.

Invited Presentation, "A 3+N-Factor Valuation Model for Interest-Sensitive Securities." (with C. Merrill and A. Remeza) *Conference on Integrated Risk and Return Management for Insurance Companies*, New York University, May 1999.

Invited Presentation, "The Ultimate Black Box." *World Conference on the Valuation of Insurance Business*, co-sponsored by the Society of Actuaries and the New York University Stern School of Business, March 1999.

Invited Discussant, "A New Approach toward the Valuation of High Yield Bonds." *Wharton Conference on Financial Institutions Management*, Philadelphia, December 1996.

Invited Discussant, "Analysis of the PIMS Model for PBGC Insurance Claims." *Wharton Conference on the Pension Information Management System of the Pension Benefit Guaranty Corporation*, Philadelphia, November 1996.

Invited Address, "Risk Management by Insurers: An Analysis of the Process." *Wharton Conference on Insurance Risk Management*, Philadelphia, May 1996.

Invited Discussant, "Fair Value of Insurance Liabilities." *Society of Actuaries*, New York, December 1995.

Invited Address, "Political Risk Insurance and Reinsurance." *Inter-American Development Bank*, Washington, D.C., September 1995.

Guest Lecture, "Franchise Value and Insurance Regulation." *General Accounting Office National Meeting*, Washington, D.C., June 1995.

Invited Lecture, "Insuring Sovereign Debt Against Default." *World Bank*, Washington, D.C., June 1995.

Invited Lecture, "International Reinsurance Markets and Practices." *World Bank*, Washington, D.C., April 1995.

Invited Address, "Basis Risk in Insurance Asset/Liability Management." *Institute for International Research Conference on Asset/Liability Management for Life Insurance*, New York, September 1995.

Invited Address, "Default Risk and the Duration of Bonds." *2nd Biennial Conference on the Financial Dynamics of the Insurance Industry*, New York University Salomon Center, New York City, May 1995.

Distinguished Lecture, "Tobin's Q Ratio and Insurer Interest Rate Risk Management." *Brigham Young University*, Provo, Utah, October 1994.

Invited Address, "On Model Insurance Investment Laws." *N.A.I.C. Conference on The Future of Insurance Solvency Regulation*, Washington, D.C., February 1994.

Moderator and Advisory Board, "Risk-Based Capital for Insurers." *Insurance Investment Forum*, Institutional Investor, Palm Beach, Florida, December 1993.

Guest Lecture, "Investment Strategies for Insurers and Pension Funds around the World." *World Bank*, Washington, D.C., December 1993.

Presented, "Generalized Put-Call Parity." (with L. Eisenberg) *Financial Management Association*, San Francisco, October 1992.

Presented, "Quantity-Adjusting Options and Forward Contracts." (with L. Eisenberg) *Financial Management Association*, San Francisco, October 1992.

Guest Address, "Life Insurance in the Year 2000." *Chief Investment Officers' Conference*, Chicago, February 1992.

Guest Address, "Measuring Investment Performance in an Asset/Liability Context." *Association for Investment Management and Research*, New York, December 1991.

Guest Address, "Performance Measurement for Insurers." *International Insurance Seminar*, San Francisco, June 1991.

Guest Address, "Performance Measurement for Insurers." *Chief Investment Officers' Conference*, American Council of Life Insurance, Tucson, March 1991.

Distinguished Lecture, "Toward a Consensus Theory." *Pennsylvania State University*, West Chester, November 1990.

Presented, "Interest Rate Sensitivity and the Value of Insurer Surplus." (with K. Staking) *American Risk and Insurance Association*, Orlando, August 1990.

Invited Presentation, "New Directions in Asset/Liability Management." *Society of Actuaries*, San Francisco, June 1990.

Presented, "Capping the Interest Rate Risks in Insurance Products." *American Risk and Insurance Association*, Denver, August 1989.

Keynote Lecture, "Hedging Uncertain Insurer Liabilities." *Life Insurance Companies Annual Retreat*, Cape Cod, summer 1988.

Invited Presentation, "Gazing into the Insurance Future." *Society of Actuaries*, Boca Raton, April 1988.

Invited Presentation, "Asset/Liability Management for Insurers: Information Management." *I.B.M. Insurance Marketing Conference*, Palm Springs, April 1988.

Keynote Speaker, "Asset/Liability Management for Insurers." *Chief Investment Officers' Insurance Conference*, Key Largo, February 1988.

Guest Address, "Duration and the Term Structure of Interest Rate Volatility." *Southwest Actuarial Society Convention*, Austin, November 1985.

Invited Presentation, "Aspects of Optimal Multiperiod Life Insurance." *Operations Research Society of America*, Atlanta, November 1985.

Distinguished Lecture, "Multifactor Models of the Term Structure of Interest." *Laval University*, Québec City, Canada, May 1985.

Guest Address, "Financial Economics Perspectives in Insurance." *Plenary Session of the American Risk and Insurance Association*, Minneapolis, August 1984.

Presented, "Aspects of Optimal Multiperiod Life Insurance Contracts." *American Risk and Insurance Association*, Minneapolis, August 1984.

Presented "The Brennan and Schwartz Two-Factor Model of the Term Structure of Interest: Empirical Extension." *Academy of International Business*, Singapore, June 1984.

Guest Address, "The International Debt Crisis in Brazil and Prospects for Repayment." *Invited speaker before officials of the U.S. Treasury, State, Commerce and Senate*, Washington, D.C., May 1984.

Presented, "Determinants of Demand for Life Insurance: A Time Series Study." *American Risk and Insurance Association*, Philadelphia, August 1983.

Invited Presentation, "The Term Structure of Interest Rate Volatility: A Binational Comparison." *Western Economics Association*, Los Angeles, July 1982.

Invited Presentation, "The Pareto Optimal Design of Term Life Insurance Contracts." *L'Association Française de Finance*, Orleans, France, June 1982.

Invited Presentation, "Duration and the Term Structure of Interest Rate Volatility." *World Conference on Duration: State of the Art*, Ashland, July 1981.

Discussant of, "Optimal Risk Retention Under Partial Insurance." *Western Finance Association, Jackson Hole*, June 1981.

Presented, "Anticipated and Unanticipated Inflation and the Real Value of Equities: An International Comparison." (with J. Wilcox) *Western Finance Association, Jackson Hole*, June 1981, and *Western Economics Association, San Francisco*, July 1981.

Invited Presentation, "Financing Economic Development: The Case of Gambling and Insurance in Brazil." *Stanford University Colloquium on Latin American Studies*, April 1980, and *Latin American Studies Association, Bloomington*, November 1980.

Presented, "Inflation, Indexation and Life Insurance Sales in Brazil." *Western Finance Association, San Diego*, June 1980.

Discussant of, "Are Export Controls Anti-Inflationary?" *American Economic Association, Atlanta*, December 1979.

EXECUTIVE EDUCATION PROGRAMS

Guest Lecturer, "Rational Accumulation and Decumulation." AXA, Thrivent, Prudential, Merrill Lynch, KPMG, and other companies. *Wharton School*, 2005-2011.

Guest Lecturer, "The Theory of Consensus." *Federal University of Goiás; Federal University of Mato Grosso; INESC of Minas Gerais; Sindicato dos Administradores do Tocantins, SAETO*; (these 3 universities and 1 professional association are located in Brazil), 2004-2005.

Invited Presentation, "Valuation and Value Creation in Reinsurance." *Swiss Re Group, Zürich*, July 2001.

Director and Lecturer, "Advanced Asset/Liability Management for Life Insurers." *Society of Actuaries and Wharton School, Philadelphia*, 1988-2011.

Director and Lecturer, "Modern Valuation and Risk Management Techniques for Insurers." *General Electric Corporate Research and Development, Schenectady*, 1998.

Guest Lecturer, "Asset/Liability Management for Insurance Companies and Pension Funds around the World." *World Bank, Washington, D.C.*, September 1995, September 1994.

Lecturer, "Investment Policy and Private Pensions." *Brazilian Leaders of Private Pensions and Social Security, Wharton School, Philadelphia*, November 1993.

Guest Lecture, "Investment Strategies for Insurers and Pension Funds around the World." *World Bank, Washington, D.C.*, December 1993.

Invited Lecturer, "Investment Policy and Private Pensions." *Brazilian Leaders of Private Pensions and Social Security, Wharton School, Philadelphia*, November 1993, 1997.

Director and Lecturer, "Financial Markets and Strategies for Credit Card-Backed Receivables." *Discover Credit Card, Wharton School, Philadelphia*, 1993, 1992.

Director and Lecturer, "Liability Management for Central Banks and Ministries of Treasury." *Treasury Department*, Ankara, Turkey, 1992, 1990.

Lecturer, "Financial Executive Development Program for Bell Atlantic Corporation." *Wharton School*, Philadelphia, Pennsylvania, summer 1986.

Lecturer, "Programa Ejecutivo IESA." *Instituto de Estudios Superiores de Administración 2-week Executive Program*, Caracas, Venezuela, February 1985.

Lecturer, "Strategic Financial Management and Control." *Middle East Management Consultants 5-day Seminar*, Bahrain, December 1984.

Lecturer, "Intensive Program on Offshore Banking." *Bankers Institute of Taiwan 4-day Seminar*, Berkeley, California, July 1984 and July 1983.

Lecturer, "Offshore Banking and International Capital and Money Markets." *Development Bank of Taiwan 3-day Seminar*, Taipei, Taiwan, November 1982.

Lecturer, "International Banking and Finance." *Bankers Institute of Taiwan 5-day Seminar*, Taipei, Taiwan, August 1982.

Fellow, "International Business Education—The Japanese Case Study." *Japan-America Society 2-day Seminar*, Los Angeles, California, February 1982.

Fellow, "International Treasury Management." *Bank of America 5-day Workshop*, San Francisco, California, August 1981.

Fellow, "Foreign Exchange Exposure." *Bank of America 5-day Workshop*, San Francisco, California, July 1980.

Lecturer, "Indexation of Financial Instruments." *Seminar in Applicable Capital Market Theory*, Haas School of Business, Berkeley, California, December 1978.

EDITORIAL SERVICE

American Economic Review, California Management Review, Financial Management, Geneva Papers on Insurance and Economics, Journal of Applied Economics, Journal of Banking and Finance, Journal of Business, Journal of Finance, Journal of Financial and Quantitative Analysis, Journal of Financial Intermediation, Journal of Financial Research, Journal of Futures Markets, Journal of International Business Studies, Journal of International Money and Finance, Journal of Political Economy, Journal of Risk and Insurance, Management Science, North American Actuarial Journal, Risk Management and Insurance Review.

COURSES TAUGHT

Investments and securities markets

Executive level (Berkeley and Wharton)

- Graduate level (Berkeley and Wharton)
- Undergraduate level (Berkeley and Florida)
- Financial management
 - Graduate level (Berkeley and Wharton)
 - Undergraduate level (Berkeley)
- International financial management
 - Executive level (Berkeley)
 - Graduate level (Berkeley)
- Advanced Asset/Liability Management
 - Executive level (Wharton)
- Financial Strategies and Analysis: Insurance (advanced fixed-income course)
 - Graduate level (Wharton)
 - Undergraduate level (Wharton)
- Advanced corporate finance
 - Executive level (Wharton)
 - Graduate level (Wharton)
 - Undergraduate level (Florida, Wharton)
- Structured notes and asset-backed securities
 - Graduate level (Wharton)
- Risk and Crisis Management
 - Graduate level (Wharton)
- Risk Management
 - Undergraduate level (Wharton)
- Principles of Risk and Insurance
 - Graduate level (Wharton)
 - Undergraduate level (Wharton)
- Doctoral Seminar in Life Insurance—various sessions
 - Doctoral level (Wharton)
- Macroeconomics
 - Undergraduate level (Brigham Young University)

February 24, 2014

Exhibit 2

Retention Letter

February 24, 2014

Charles River Associates



January 31, 2014

Jayant W. Tambe
Lauri Washington Sawyer
Jones Day
222 East 41st Street
New York, New York 10017-6702

RE: Claims asserted by the Tobacco Settlement Authority of the State of Washington in In re Lehman Brothers Holdings Inc., et al., Chapter 11 Case No. 08-13555 (SCC)

Dear Counsel:

I would like your confirmation that Jones Day, acting on behalf of its client, Lehman Brothers Holding, Inc. ("Lehman"), has retained Charles River Associates ("CRA") to provide services in connection with the above-referenced claims. Specifically, Lehman has engaged David Babbel (the "Expert") to provide expert witness services in connection with these claims, including but not limited to the preparation and submission of an expert report and testifying at a deposition and a hearing on these claims.

In establishing and maintaining good relationships with our clients, we have found it important to provide each client with a statement of our engagement practices and billing policies. These practices and policies are set forth in our attached Terms and Conditions, which are incorporated herein by reference and which are intended to safeguard our client information, establish reasonable fees for our services, and provide for the billing and collection of those fees in a timely manner.

CRA and the Expert will provide its services hereunder on a time and materials basis, and will invoice for actual hours worked and expenses incurred. David Babbel's hourly billing rate is \$745, Mark Meyer's rate is \$605, and my rate is \$680. Our fees, exclusive of expenses, will be capped at \$75,000. CRA and Jones Day both understand and agree, however, that this amount was determined based on the assumption that the preparation of the expert report and appearance at both deposition and a hearing would require no more than 100 hours of the Expert's time (or the equivalent cost for the Expert and those supporting him to see the engagement through completion). Should unforeseen circumstances arise that require a substantially greater effort on the part of CRA, or should we be required to participate in any appeals or related proceedings, CRA shall have the right to either request that the approved budget amount be increased, or to terminate this engagement without further liability. We will of course work closely with you and Lehman to manage our level of effort as the matter progresses.

All invoices will be submitted to Jones Day for prompt delivery to Lehman for payment. Although CRA has been retained by Jones Day to provide services with respect to matters pertaining to Lehman, we recognize that Lehman is our ultimate client. CRA will look to Jones Day for assistance in collection of all fees owed to CRA by Lehman.

If the above meets with your approval and Lehman has agreed to our retention, please sign and date a copy of this letter and return it to me. Thank you for your confidence in our ability to assist you and your client. We look forward to working with you.

One South Wacker Drive 34th Floor Chicago, Illinois 60605 312-357-1000 312-357-1001 fax

NY1-4569482v1

February 24, 2014

Charles River Associates

Jayant W. Tambe
Lauri Washington Sawyer
January 29, 2014
Page 2

Privileged and Confidential

Sincerely yours,

Charles River Associates



Nichols J. Weir
Vice President

NJW/dms

Enclosure

Accepted by:

Jones Day



Signature

OF COUNSEL, JONES DAY

Print Name and Title

2/10/14

Date

NY1-4569482v1

February 24, 2014

Charles River Associates

Terms and Conditions

Confidentiality

All of CRA's work for clients is confidential. CRA staff members and consultants have signed confidentiality agreements and are obligated not to disclose any confidential information or documents used or obtained in the course of our work. Additionally, the Expert will not publish any article that discloses confidential or proprietary information without written authorization of Lehman and Jones Day. The obligation of confidentiality does not apply to data or information which: (1) is or becomes generally available to the public other than as a result of a disclosure by CRA or any of its representatives; or (2) was in CRA's possession prior to the time it was disclosed to CRA by you or your client; or (3) is disclosed to CRA by a third party who is under no obligation of confidentiality to you or your client. ~~Should CRA be compelled by any valid court or administrative order to disclose any confidential information held in connection with this engagement, we will first notify you and will cooperate, to the extent practicable, with any attempts to legally limit or avoid such disclosure.~~

IF CRA should be served with a subpoena or otherwise requested to provide confidential information relating to this engagement, CRA will immediately advise Lehman of the request so that Lehman has the opportunity to take necessary and appropriate actions to protect its interests. NTW
Relationship *WVS*
 The role of CRA is solely that of an independent contractor. In no event shall this agreement or any and limit the work performed by CRA create a relationship of principal and agent, partnership or joint venture, or disclosure of any fiduciary relationship between the parties. This agreement may be terminated, at the discretion of either party, on ten (10) days' written notice, or earlier with the consent of both parties. CRA will be compensated for all services rendered and expenses incurred by CRA up to the date of termination. *CRA will cooperate to the extent practicable, with any attempts to legally limit or avoid such disclosure.*

Under this agreement, CRA will provide consulting expert services and will report on the progress of our work, either orally or, if requested, in written form. CRA will offer independent, objective opinions and analysis. Jones Day confirms that Lehman has authorized Jones Day to enter into this agreement with CRA on Lehman's behalf. CRA shall perform services at the direction of Jones Day without further confirmation from Lehman. Jones Day shall bear the responsibility of keeping Lehman apprised of CRA's efforts. The work being undertaken by the Expert and CRA in support of the Expert, is being done for the Client under the direction of Jones Day in anticipation of litigation and, accordingly, is part of Client's work product.

Data Handling

Any nonpublic information you have supplied to CRA will be kept confidential with at least the same degree of care as we use for our own materials. It is your obligation to inform CRA at the outset of the engagement of any special data handling, storage, or destruction requirements. CRA shall take appropriate steps to accommodate your data handling, storage, and destruction needs on the understanding that certain measures may incur additional expense, which shall be borne by your client. Unless other terms are agreed or there is an order or other legal requirement to the contrary, upon the conclusion of the provision of services under this retention, CRA may destroy or return to you all information related to this retention (hard-copy or electronic). CRA reserves the right to bill your client for such destruction or re-delivery activities. CRA reserves the right to maintain copies (at its expense) of such material as it deems necessary for administrative, legal, or regulatory purposes. The terms of this paragraph shall survive the termination and/or the expiration of this agreement.

Liability

The total liability of CRA shall be limited to the total amount of fees paid to CRA under this engagement. Under no circumstances shall CRA be liable for any (1) loss of profits; (2) loss of sales; (3) loss of turnover; (4) loss of or damage to business; (5) loss of data; (6) business interruption; (7) wasted management or other staffing; (8) loss of customers; (9) indirect, consequential, incidental, One South Wacker Drive 34th Floor Chicago, Illinois 60606 312-357-1000 312-357-1001 fax

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Charles River Associates

or special damages. For the purposes of this paragraph, the term "loss" includes a partial loss or reduction in value as well as a complete or total loss. None of the foregoing exclusions and limitations on liability shall apply in respect of (a) liability in negligence causing personal injury or death; (b) liability for fraudulent misrepresentation; or (c) any other liability which cannot by law be excluded or limited (as appropriate). The terms of this paragraph shall survive termination and/or the expiration of this agreement.

Billing and Payment

CRA will bill Client on a monthly basis and will provide sufficient detail to allow Client to identify services rendered and expenses incurred. Bills may be sent more frequently at the request of the Client. All invoices are due and payable upon receipt. CRA reserves the option to charge interest on invoices that are outstanding more than forty-five (45) days, at a rate equal to the lower of 1.5 percent per month or the maximum rate permitted under applicable law. The obligation to pay CRA's fees and expenses is not contingent upon the results of the services or any suit or matter in connection with which the services are provided.

Any objection with respect to CRA's invoices must be made by the client in writing within fifteen (15) business days following receipt of the invoice to which objection is made. CRA reserves the right to suspend and/or terminate services, withhold any report or deliverable, and to prohibit the client from using or permitting the use of any report or any portion thereof until all of CRA's fees and expenses incurred to date have been paid in full. CRA may request a retainer at any time. CRA's hourly rates and costs are subject to periodic change.

All fees, expenses and other amounts payable to CRA in connection with this Agreement or the services provided hereunder shall be payable solely by Lehman in accordance with this Agreement, and Jones Day shall have no obligation to CRA with respect to fees or expenses or otherwise, nor shall Jones Day be liable to CRA or to any other party for any obligations, liabilities or damages incurred or amounts owed in connection with or as a result of CRA's engagement or its performance of services hereunder.

Miscellaneous

In the event that the scope and/or parties to this retention change after the commencement of CRA's services hereunder, CRA reserves the right to decline to provide further services and terminate this retention without liability, unless CRA determines that such change in scope and/or parties will not create a conflict of interest for CRA. You will from time to time provide to us such information and documentation as we may request to comply with our obligations under applicable anti-money laundering or similar legislation in any relevant jurisdiction. We may decline to act or to continue to act for you until you have complied with any such request.

The parties agree that an email agreed to by the parties regarding change of scope, pricing of fees and out of pocket expenses shall be sufficient evidence to approve such changes. In the event that CRA is required to undertake collection efforts for unpaid invoices, client shall also be responsible for payment of CRA's reasonable attorneys' fees and costs associated therewith. If CRA is required by government regulation, protective order, subpoena, or other similar legal requirement that may arise during or after the pendency of this agreement, to produce or destroy documents or provide personnel as witnesses with respect to the services or this agreement, CRA shall be reimbursed for its professional time and expenses, as well as reasonable attorneys' fees and expenses, including the allocable cost of in-house counsel, incurred in responding to such requests.

Neither party shall be liable in damages or have the right to terminate this agreement for any delay or default in performing hereunder if such delay or default is caused by conditions beyond its control including, but not limited to acts of God, government restrictions, wars (declared or undeclared), acts

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or threats of terrorism, pandemic, insurrections and/or any other cause beyond the reasonable control of the party whose performance is affected.

The client may not use the name, trade name or mark of CRA, any of its subsidiaries or its employees in any marketing or similar promotional materials, including websites or press releases without the express written consent of CRA, unless required by law. Charles River Associates is a registered trade name of CRA International, Inc., which is the entity being retained herein.

This Agreement shall be governed by and construed in accordance with, the laws of the State of New York, without giving effect to its principles of conflicts of law, and the parties agree that any controversy, dispute, or claim of whatever nature arising out of, in connection with, or in relation to the interpretation, performance or breach of this Agreement, including any claim based on contract, tort, or statute, shall be heard by the United States Bankruptcy Court for the Southern District of New York in which Lehman's chapter 11 case currently is pending.

Entire Agreement

This agreement constitutes the complete and exclusive statement of the parties in relation to the subject matter hereof; sets forth all obligations of the parties in relation to the subject matter hereof; supersedes all prior or simultaneous written or oral proposals, estimates and understandings relating thereto, all of which are expressly excluded.